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RCS Residential Conservation Service

ORIGINAL

Your Home Energy Audit: The First Step to More Energy-Efficient Living

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Your Home Energy Audit: The First Step to More Energy-Efficient Living

United States Department of Energy
Technical Assistance Program
for the
Residential Conservation Service Program

Solar Energy Research Institute
Golden, Colorado

Oak Ridge National Laboratory
Oak Ridge, Tennessee

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Your Home Energy Audit the First Step...

Now that a home energy audit has been performed on your home, you may be asking, "What next? How can I take the many recommendations of my auditor and actually put them to use to start saving energy and money?"

This booklet, used with your Audit Results, will help you decide the next steps you can take toward more energy-efficient living. The booklet presents information about you and your family—how you use energy, what it costs, and what you can do to cut back on your energy use and save money in the process.

Your home energy audit, although tailored to reflect your family's unique living situation and your individual home, was conducted as part of the national Residential Conservation Service (RCS) Program. As part of the National Energy Conservation Policy Act passed by Congress (P.L. 95-619), your utility company or home heating fuel supplier is required to offer audits to residential customers like yourself. By performing audits and encouraging the use of energy conservation and renewable resource measures, these firms are helping to increase the entire nation's energy efficiency. Better use of our energy at the national level will assist in reducing oil imports, will aid the balance of payments, will help slow the pace of inflation, and will conserve natural resources. Because 20% of all U.S. energy is used in homes like yours, the RCS Program is expected to have an important impact on national energy consumption.

Conserving and Producing Energy

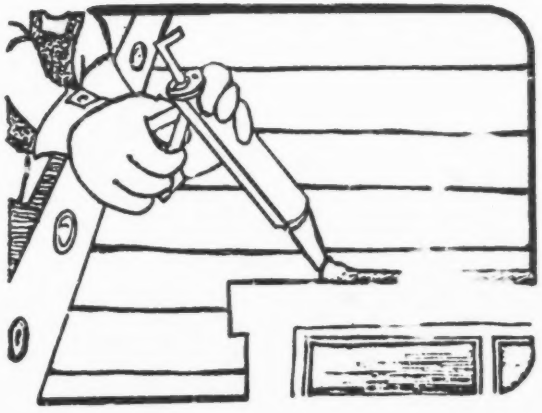
Energy efficiency in a home can be increased by either adopting energy-conserving measures or by producing energy from renewable resources. Either way, the amount of purchased energy used at home can be decreased. Your RCS home energy Audit Results, this booklet, and your specially trained auditor all cover both energy-conserving and renewable resource energy-producing measures as they apply to your home.

You and your family can reduce the amount of purchased energy used in your home and still maintain year-round comfort with energy-conserving **practices** and energy-conserving **measures.**

Energy conservation practices are low-cost or no-cost steps you can take yourself to reduce your energy use and costs immediately. Such steps include adjusting your furnace and hot water heater thermostats and sealing air leaks.

Energy conservation measures are products you can have someone install, or install yourself, to further reduce your energy use. Examples of such measures are home insulation and caulking and weatherstripping of doors and windows. These measures will begin to save energy in your home as soon as they are installed. Your auditor has checked to see which of the following are appropriate for your home:

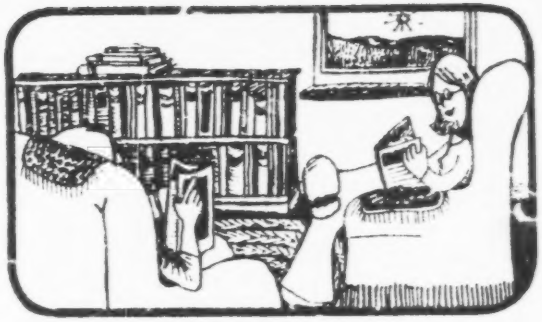
- caulking and weatherstripping
- window and door treatments
- heating system adjustments
- insulation
- clock thermostats
- replacement boilers/furnaces
- replacement central air conditioners
- electric load management devices



Renewable resource measures allow the sun to provide some of your energy in the form of heat or electricity. By providing some of your own energy, you reduce the amount of energy you must purchase, thus reducing your utility bills. Your auditor has checked to see which of the following are appropriate for your home:

- solar hot water heaters
- active solar heating systems
- combined solar hot water and heating systems
- direct and indirect gain passive heating systems
- solar greenhouses
- window heat gain retardants
- wind energy systems
- replacement solar swimming pool heaters

The Audit Results show which of these measures are appropriate for your home.



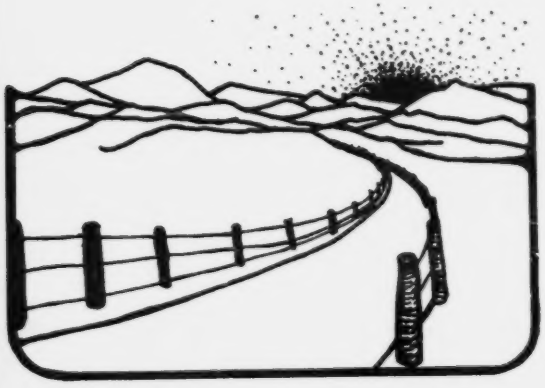
How You Use Energy in Your Home

Most of the energy you buy from energy suppliers (utility companies or heating fuel suppliers) is used for heating, cooling, and hot water. The practices and measures described in this booklet apply to these major uses of energy in your home. For example, the amount of purchased energy you use to heat water can be decreased by adopting a practice (turning down the temperature of your hot water heater), by installing a conservation measure (insulating your hot water heater), or by installing a renewable resource measure (a solar hot water heater).

Some Work For Your Home and Others Don't

Not every energy conservation and renewable resource measure included in the RCS home energy audit necessarily applies to your particular household. The Audit Results you received with this booklet tell you which things you can do in your home to increase energy efficiency, and which things are not advised for you under the assumptions in RCS audit. Although this booklet describes all the practices and measures covered in the RCS audit, the Audit Results show the specific practices and measures appropriate for your home. The Audit Results also explain why other measures are not appropriate.

For those measures that are considered generally applicable to your home, the Audit Results provide estimates of how much they will cost and how much money you can save in one year of utility billings.



A Word to the Wise

When it comes to energy conservation and renewable resources, the final choice is yours. Only you can make decisions about what is best for your situation, based on sound information from your audit and other sources.

A range of energy conservation and renewable resource measures might be appropriate for your home, yet you may choose to start with one or two, and do others later. **Each measure will save you a certain amount of your energy costs, but because some of these measures act together and not individually, don't expect to add up all the estimated savings to a figure greater than your fuel bill.** The following is an example of what this means in actual dollar figures.

Imagine a house in Columbus, Ohio, with 1500 square feet of living space. It is heated by an inefficient furnace that is too large for this particular house. In addition, the house is poorly insulated (R8 in the attic only). The people who live there are paying $560 each year to heat their home. After inspecting their home, the auditor told them they could save approximately:

- o $65 the first year by adding R-22 insulation to their attic;
- o $90 the first year by installing a vent damper and electric ignition on their gas furnace; and
- o $110 the first year by installing a passive solar space heating system to provide 20% of their heating needs.

At first glance you might think that by using all three suggestions the Columbus family could save $65 + $90 + $110 for a total of $265. Yet, this total overstates their possible savings from the combination of these three measures. Calculations show the true savings from following all three suggestions would total about $225 each year, because the effects of each measure overlap in saving energy used for heat.

The overlap for some combinations of measures may be even larger. These calculations have not been done specifically for your house because they are complex and time consuming.

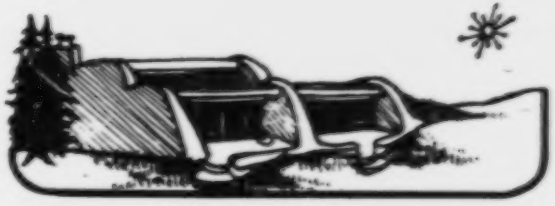
Calculating specific savings is not an exact science. Many factors are involved. The procedures used to make the RCS home energy audit cost and savings estimates are consistent with the Department of Energy's criteria for residential energy audits. Although the estimates reflect an actual inspection of your home, they are also based on certain assumptions which may not be totally accurate for your household. The actual costs you incur and energy savings you realize from making the suggested improvements may differ from the actual audit estimates.

Although you will gain a great deal of knowledge on energy costs and savings through your audit, your auditor cannot predict precise costs and savings for your particular home and living patterns. It is advisable to contact several listed suppliers or contractors for cost bids specific to your home. (Your energy supplier can arrange to get cost bids for you, if you wish.) You may want to obtain bids for different types of products and systems before you make your final purchasing decision. Keep in mind that prices will vary with the quality and capability of the product. When you compare bids, evaluate them for products and systems of a similar type, quality, and capability.

don't forget . . .

If fuel prices continue to increase in your area, you will probably realize even greater savings than those estimated. Your auditor's calculations are based on recent utility costs and may not take into account any rapid increases or other changes.

When normal wear and tear dictate replacing a major item such as a hot water heater, furnace or air conditioner, consider the recommendations from your home energy audit before you make a purchase. Even if you decide not to purchase a particular measure now, your auditor's suggestions will still come in handy later on. It is a good idea to keep this booklet and your Audit Results and refer to them in the future.



You Can Receive Services

Through the RCS Program your utility company or home heating supplier (energy supplier) offers 5 different services:

- o performing home energy audits,
- o arranging installation of program measures,
- o arranging financing for installations through your utility company or home heating supplier,
- o lists of participating contractors, suppliers and lenders, and
- o billing for loans on your fuel or utility bill.

Because the extent of services to be performed by energy suppliers varies by state, you may want your auditor to explain further the specific services for your area. Services described here are the minimum required under the RCS Program.

If you have your energy supplier arrange installation or if you purchase RCS-labeled materials for do-it-yourself projects from the list of participating suppliers, you will be eligible for benefits developed especially for the RCS Program.

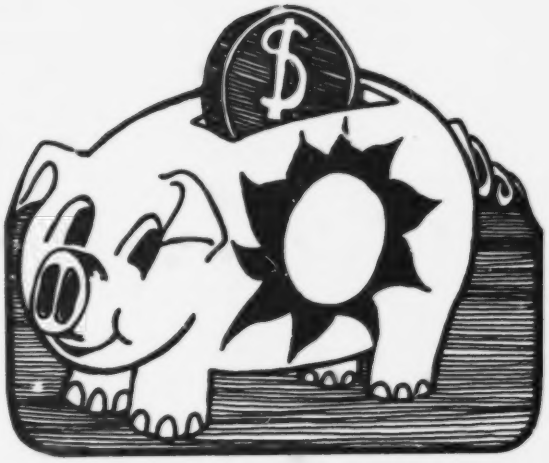
Arranging for installation. Your utility company or home heating supplier will help you arrange for the installation by a contractor of energy conservation and renewable resource measures appropriate for your home. If you take advantage of this service, you will receive:

- a limited product warranty (except for caulking and weatherstripping) which guarantees that the product has a useful life of at least 3 years.
- installation by a participating contractor of products that meet applicable standards for quality and effectiveness.
- installation of products according to applicable safety standards.
- mandatory post-installation inspection of 3 products that might present safety risks if they are improperly installed: (1) vent dampers, (2) electric ignition systems, and (3) wind energy systems. These inspections will be conducted within one week of installation.
- quality control for all installations through a program of state/energy supplier coordinated inspections of a sampling of all contractor work.

Arranging for financing. If you need help with initial costs, your utility company or home heating supplier will also help you arrange financing through lenders participating in the RCS Program. This service is available to you only if your energy supplier arranges installation for you. If the lending institution agrees, your loan may be repaid through your energy supplier along with your fuel bill.

If you are a do-it-yourselfer, your energy supplier will help you arrange financing for RCS-labeled products purchased from participating suppliers.

Any costs you might incur for the RCS Program audit or repayment of loans you receive under the Program will be individually listed on your fuel bill.



Do-it-yourself installation. If you enjoy doing home improvement projects, you can buy materials from suppliers such as hardware stores, lumber companies and other retail outlets in your area who are participating in the RCS Program. To participate in RCS, these businesses have agreed to provide for RCS measures:

- products with a limited warranty (except for caulking and weatherstripping) which guarantees that the product has a useful life of at least 3 years.
- materials that meet applicable standards for safety and effectiveness.

Be sure to check for RCS labels on products, since not all products sold by these suppliers have these guarantees.

Consumer protection. Your auditor has given you lists of contractors, suppliers and lenders participating in the RCS Program.

If any problems arise with a contractor, supplier, or lending institution, your energy supplier has 3 consumer protection procedures to help you resolve them quickly:

- o conciliation conferences to informally resolve customer complaints against sellers, installers or lenders;
- o redress for all persons alleging injury from activities related to the Program; and
- o civil action for all persons seeking damages from an injury arising from activities related to the Program.

If need arises, contact your auditor for further information about consumer protection procedures in your state.

REMEMBER: A home energy audit does not automatically make you eligible for these benefits. You are eligible only if you have your energy supplier arrange installation or, for do-it-yourself projects, if you buy your RCS-labeled materials from a listed supplier. Contact your utility company or home heating supplier if you want to have installation arrangements made for you.

The Government Offsets Some of the Cost

Throughout this booklet, measures that may be eligible for federal income tax credits are indicated by this picture:

In fact, most energy conservation and renewable resource measures are eligible. The total tax credits available to you for these measures apply as long as you live in your present home. If you move after having received your tax credits, they are once again available to you in your new home. You can receive tax credits only once for each measure you install for each home you live in.

In general, for energy conservation measures, individuals are allowed a tax credit of 15% of expenditures (up to $2,000) for the period of time that they live at one residence if it was substantially completed before April 20, 1977. The total tax credit cannot exceed $300. This credit is subtracted directly from the amount of income tax you owe the federal government, with any balance due you carried over to following years if necessary. You compute your payable tax and subtract your tax credit from that amount. If you move to a different residence, you are once again eligible for the tax credit.

For example, if you spent $1,200 for wall insulation added to your home, you could subtract $180 from the federal income taxes you would otherwise owe. Your net cost for the insulation would then be $1,020.

For renewable resource measures, individuals are allowed a tax credit of 40% of the first $10,000 in expenditures. That is, the total renewable resource tax credit cannot exceed $4,000 for the period of time that you live at your current residence as long as installation takes place after April 19, 1977. The credit amount is subtracted directly from the income tax you owe the federal government, with any balance due you carried over to following years if necessary. If you move to a different residence, you are once again eligible for the tax credit.

For example, an individual paying $2,400 for a solar energy system to heat water for his or her home would receive a tax credit of $960--that is, 40% of the system cost. In effect, the cost of the solar hot water system would be $1,440, or the purchase price of $2,400 less the $960 tax credit.

An example of how the tax credits can work for you is provided on your Audit Results for two measures recommended for your home.

More information on the federal energy tax credits can be found in IRS Publication 903. Before filing your income tax, you should check this publication for legal requirements regarding these credits. Your local or regional IRS offices will provide you with a copy upon request.

don't forget . . .

Many states offer additional financial incentives for energy-conserving measures, such as state income tax credits. These can be added to the federal tax credits for even more savings.

The Low Income Weatherization Assistance Program is available for some families who could not otherwise afford to install energy conservation measures in their homes. If you meet certain requirements for family size and income level, or if you are a senior citizen, you may be eligible for this assistance. Your auditor can describe who is eligible for this program and explain its benefits.

For the Do-It-Yourselfer

Many people enjoy saving money by doing home improvement projects themselves. In the Audit Results, cost estimates for many of the measures are given for those interested in doing their own installations. In a few cases, it is noted that do-it-yourself installation is not encouraged due to the need for special knowledge.

Where and How to Find Out More

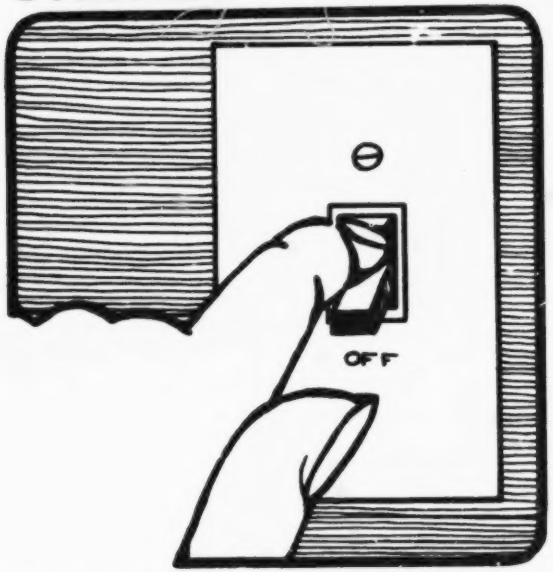
As with many topics, the more you know about energy, the more you want to know. Names, addresses and toll-free telephone numbers of organizations that can provide information to you are provided at the end of this booklet. In addition, many states have state energy offices and solar energy offices which are useful sources of information.

A Final Thought

A home energy audit does not save energy or reduce costs, people do. Only by adopting some of the practices and measures recommended for your home will you save energy and money. The home energy audit is just the first step—your energy supplier offers a variety of services to help you do the rest!

Notes:

Energy Conserving Practices



The first step to take, before you do anything else, is to adopt energy conserving practices. Conserving energy in your home can be easy and inexpensive. You can reduce your energy use for heating, hot water, and cooling up to 25% if you follow your auditor's suggestions. Many energy conserving practices cost little or nothing, but involve simple adjustments to existing equipment or slight changes in your energy use habits. These practices will be most effective when they zero in on:

- o heating or cooling systems,
- o hot water use, and
- o places in the home where heat is most likely to be lost.

Although some of the suggestions are described in more detail than others, all are equally important in making yours a more energy-efficient home. For best results, we recommend that you follow your auditor's suggestions for these energy conserving practices first. Then, consider adopting the energy conservation and renewable resource measures appropriate for your home.

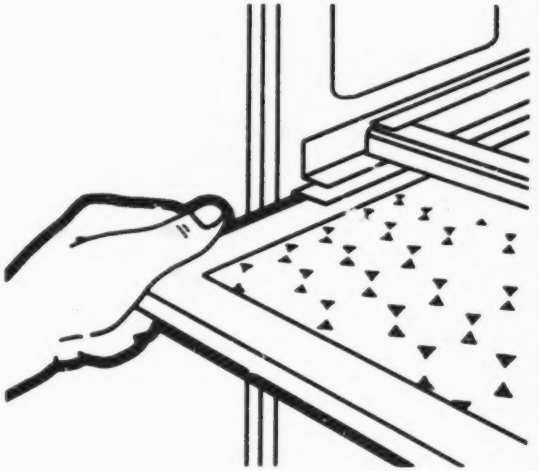
If you prefer, you may make many of these adjustments yourself; all the necessary supplies are generally available at several types of retail outlets. Many of these stores are included in the list of RCS suppliers. A furnace service representative can also help.

After you purchase supplies, be sure to read the manufacturer's directions for proper installation carefully to ensure safety and best results.

HEATING AND COOLING SYSTEM ADJUSTMENTS

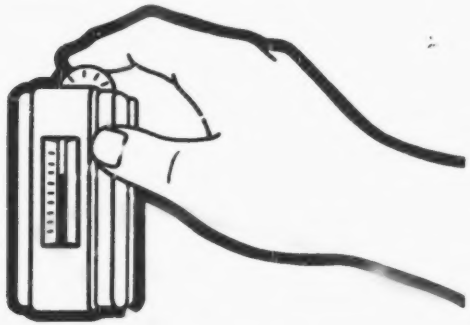
- o Keep your heating system tuned up, just like you would your car, for peak operating efficiency. Before the beginning of each heating season, have a service representative check your furnace to make sure that it is working properly. If you have a gas or oil furnace, the service representative can start by cleaning and adjusting your burner.

Clean or change air conditioner and furnace filters regularly. You can do this simple job yourself.



- o If you heat with a forced air system, have a service representative check the internal temperature setting of your furnace fan — the fan that forces warm air up through the duct system into the house. To conserve fuel, the furnace's internal fan-off temperature should be set at 80°F. Heated air is circulated longer at this temperature.
- o Turn off the pilot light on your gas furnace during the summer. **DON'T BLOW IT OUT!** Improperly shutting off or blowing out a pilot light can create a significant safety hazard. Even though the pilot light uses a relatively small amount of gas, shutting it off will cut down on your total fuel bill.

- The best energy-saving adjustment for your furnace is still a simple daily adjustment of your thermostat. Change the temperature setting of your heating or cooling system to lower your energy use. During the winter, lower the thermostat setting at night to no lower than 55° F. During the day, set the thermostat at 68° F— or lower, if you prefer. In the summer, set the air conditioning control at 78° F or higher.



Caution: Some older people may require higher indoor temperatures — above 65° F at all times — to avoid accidental hypothermia, a possible fatal drop in body temperature.

People with circulatory problems or those taking certain types of drugs (such as phenothiazines, commonly used to treat anxiety and nausea) may also be vulnerable. In such instances, follow a physician's advice on both winter and summer thermostat settings in your home.

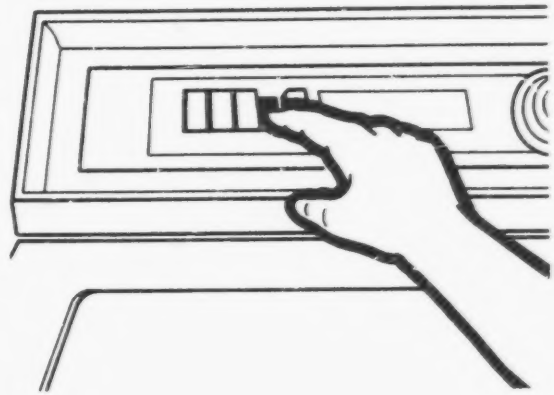
HOW TO . . .

The no-cost way to get thermostat setback savings is to turn down the thermostat at night and then turn it up again in the morning.

HOT WATER ADJUSTMENTS

Heating water for your family's showers, baths, laundry, and dishwashing account for a large part of your energy use. By reducing the amount of hot water you use each month, you can save considerable amounts of energy. To save energy and money you should:

- Install flow restrictors in shower heads and faucets. These small devices limit the water flow to a maximum of 3 gallons per minute and, in most cases, have no effect on the look and feel of the water. You can enjoy a comfortable shower and at the same time save 1 to 2 gallons of hot water per minute.
- Set the thermostat on your water heater at 120° F. At this temperature, the water will be hot enough to meet your needs. If it does not clean the dishes in your dishwasher at this temperature, raise the water heater temperature a few degrees until you are satisfied.
- Set your washing machine for a "warm" wash and a "cold" rinse. It takes about 35 gallons of water to do a full wash and rinse. A hot wash and warm rinse combination generally requires about 25 gallons of hot water. Changing the rinse water to cold does not affect the results of the wash and will save up to 8 gallons of hot water. By changing the wash setting from hot to warm, another 8 gallons of hot water can be saved.



To increase savings even further, use a cold water detergent and use cold water for both wash and rinse cycles. The results may pleasantly surprise you.

- Tighten or plug leaking joints in hot water or steam pipes.
- Replace washers in leaking faucets. A single leaking faucet can cause from 1 to 10 gallons of hot water a day to go down the drain needlessly.

HOW TO . . .

Anybody with 10 minutes to spare can reset the water heater thermostat.

For gas water heaters, you will find a temperature control knob near the bottom of the tank with "high" "medium," and "low" settings or numerical settings. Turn the knob to 120° or to the "low" setting. **NOTE:** Do not use a screwdriver or open any plates on your gas water heater.

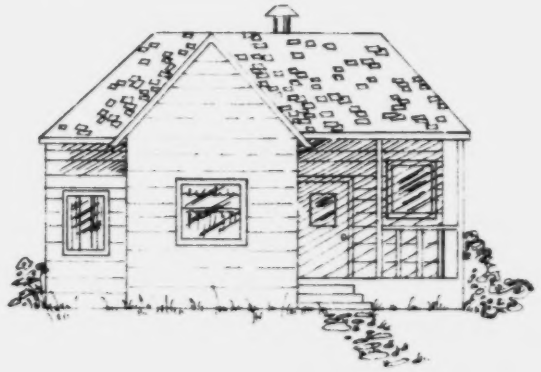
If you have an electric water heater, you will need a screwdriver to reset its thermostat. At the front of most water heaters there are 1 or 2 metal plates held on by screws. **CAUTION: turn off the circuit breaker.** Then remove the plates. Push back the insulation and you will see the thermostat. It will either have numerical settings or simply the designations "high," "medium," and "low." Reset the thermostat to 120° or "low." After replacing the insulation and the plates, turn on the circuit breaker.

NOTE: If your electric water heater is a "quick recovery" model, check for a second thermostat and turn it down, too.

PLUGGING OR SEALING LEAKS

A house is like a ship surrounded by a sea of air. In the winter, cold air tries to force its way in, like water, through every crack, while heated air tries to leak out. In the summer, hot air comes in and cooled air leaks out. Here are practices for keeping heated and cold air where they belong.

o Step into your attic some winter night. Even if it is insulated, you may be surprised to find that the attic is much warmer than the outside air. That means that some of the expensive heat you need downstairs has escaped to an area where it won't do you any good.



It is common to find large openings cut where pipes, ducts or exhaust fans pass up through the attic floor. Stuff these holes with foil-backed insulation or scrap plastic such as dry cleaning bags taped in place. Of course, don't use plastic on pipes or ducts that get hot.

Check the gap where the furnace stack or chimney meets the wood framing of the house. Fireproof insulation can be stuffed between the wood frame and the wall of the chimney. Do not use cellulose here, as it may burn.

Check for similar cracks where ducts and pipes enter an unheated basement.

o When your fireplace is not being used, be sure the damper is closed so that heated air is not lost up your chimney.

It is not unusual to find a gap of an inch or more in a fireplace with a closed damper. Because the chimney itself encourages a strong flow of air, this can create a major air leak when the fireplace is not in use. Stuff the gap with fireproof insulation or cover it with a sheet of fireproof material. Sealing the front of your fireplace with metal or glass is also effective in stopping heat losses. Of course, you will have to remove these materials before lighting your next fire!

o A great deal of heat is lost from a house underneath baseboards, through holes where plumbing pipes and telephone wires enter the house, and through holes around exhaust fans, dryer vents and sink and bathtub drains as they exit from the house. These gaps and holes should all be caulked or stuffed with insulation.

Heat can also be lost through wall outlets on exterior walls. Inexpensive electric outlet gaskets can be installed to prevent these leaks. Follow the manufacturer's instructions on installation carefully.

SHADES, CURTAINS, AND DRAPES

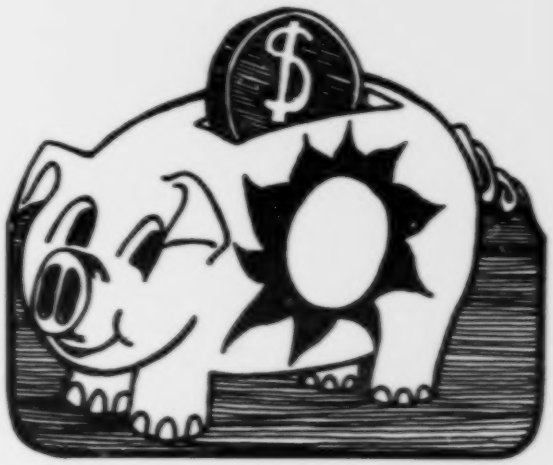
Every house is a solar collector. The trouble is, it may be collecting the sun's heat when you don't want it and releasing the heat when you do. Shades, curtains or drapes can help with this problem.

- o When you use air conditioning in the summer, keep the windows tightly covered during the day, especially on the sunny sides of your home.
- o In the summer, keep windows covered on the east side of your home in the mornings and on the west side in the afternoons.
- o Open shades and windows to use natural ventilation during summer evening and nights to cool your home when there are fresh breezes and you can turn off your air conditioner.
- o In the winter, if it is sunny raise shades and open drapes in the morning on the east and south sides of the house and close them when the sun goes down.
- o If it is sunny on winter afternoons, you can take additional advantage of natural heat from the sun by opening the shades on the west side of the house.
- o Shut windows, lower shades, and close drapes on the north windows as much as possible during the winter.

REDUCING ENERGY USE WHEN YOUR HOME IS UNOCCUPIED

You can take advantage of several opportunities to conserve energy when your home is unoccupied. Many people believe that you do not save energy by turning off heating or cooling equipment when you are away. **THIS IS NOT TRUE.** Turning equipment off always saves more energy than is used after you return to the house:

- o If your home will be empty for 4 hours or more, you can set the thermostat at 55°F.
- o Turn off your air conditioner when no one is home.
- o Turn off your water heater when you leave the house for a weekend or longer.



THESE LOW-COST, NO-COST PRACTICES CAN SAVE YOU MONEY AND ENERGY ALMOST IMMEDIATELY.

Notes:

Energy Conservation Measures

Energy costs were not usually considered when homes were built in the past. We now need to compensate for rising energy costs and smaller energy supplies. This section describes energy conservation measures which can reduce the energy used in your home: caulking and weatherstripping, insulation, energy saving windows and doors, clock thermostats, electric load management devices and heating and air conditioning efficiency modifications.

The amount of energy needed to keep your home comfortable is determined by more than just the type and efficiency of your heating or air conditioning system. This energy use is directly affected by the construction and condition of your home itself. Your home's "thermal envelope" consists of the roof, exterior walls, windows, doors and floors. Your home's thermal envelope may allow heat to flow out through it. This is called "heat loss." (It may also allow air cooled by air conditioning to escape.) And it may allow air to penetrate from the outside. This is called "infiltration."

The sunlight streaming through your windows can increase the temperature of your home. This is called "heat gain." In the winter, heat gain conserves fuel; in the summer, heat gain means more energy is used for air conditioning.

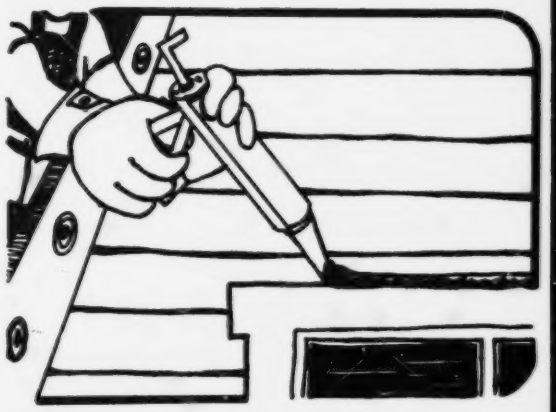
The next sections describe ways to lessen the effects of heat gain in summer, heat loss in winter and infiltration all year long, as well as other ways to reduce energy consumption in your home.

CAULKING AND WEATHERSTRIPPING

One of the most common causes of infiltration and heat loss is cracks around windows and doors. A hairline crack on the edge of a door or window frame allows the same amount of air to escape as a visible hole in your wall. Sealing these air leaks with caulking or weatherstripping is very effective.

Loose fitting windows and doors will lose heat through cracks around their edges. Weatherstripping can be applied along these edges for a tighter fit.

Installing caulking and weatherstripping is a particularly good project for you to do yourself, even if you're inexperienced with home improvement tasks. Many different types of caulking and weatherstripping are available at local stores at a range of prices. Remember, a larger initial outlay for quality products will pay off in the long run in terms of durability and effectiveness.



HOW TO . . .

Most caulking compounds (acrylic latex, butyl, or silicone) are available at lumber yards, hardware stores and conservation centers.

You need: 1" scraper or screwdriver, wire brush, caulking gun, cloth, a ladder, caulking compound (1/2 cartridge per window), and filler material (backer rod, insulation scraps or sponge rubber).

Follow these steps:

(1) Clean all surfaces of loose paint, dirt and grease before caulking to ensure good adhesion. Make sure surface is dry. (Remove old caulking as much as possible.)

(2) Fill any deep or wide cracks with filler material.

(3) Read instructions on the caulking tube very carefully.

(4) Cut the tube end at a 45° angle, puncture seal in nozzle of tube and apply evenly.

(5) When finished, disengage plunger on caulking gun and pull back to stop compound from flowing.

Insulation

As part of your audit, your home was inspected to determine where heat is being lost in the winter or gained in the summer, either by flowing through your walls, windows, ceilings, roofs, and floors, or by escaping from cracks in the building. Heat loss and heat gain can be reduced by installing insulation if it is not already present in adequate amounts in your attic or ceiling, walls, floors, and around pipes and ducts.

Insulation works by reducing or resisting heat flow. The measure of this resistance is called the "R" value. The higher the R value, the more resistance to heat flow the insulation has.

When you add insulation, you may need to add a vapor barrier. Water in the form of vapor in the warm atmosphere of your home tends to flow through the materials of the walls, floors, and ceilings to the colder outer surfaces. A vapor barrier is used to protect your insulation from this moisture; it stops the moisture before it reaches the insulation, dampens it, and reduces its effectiveness. Vapor barriers also protect the structure of your house (such as studs and joists) from moisture-induced problems. Your auditor can guide you on preferred practices in your locality. In no case should you install a vapor barrier between layers of insulation.

Insulation comes in many forms for various parts of your home.

- Batt or blanket insulation may be made of mats of mineral fibers such as rock wool or glass fibers. These mats are available with or without an attached vapor barrier and are used on unfinished attic floors or rafters, between wall studs, and on the underside of floors. Batt insulation is pre-cut to fit into specific areas of your house.
- Loose fill insulation is made of cellulose, rock wool, glass wool, vermiculite, and other materials. Loose fill insulation can either be poured or blown in place and is installed on unfinished attic floors, over existing insulation in finished attic floors, and in finished walls.
- Foamed in-place insulation is generally made from a urea-formaldehyde compound. Special equipment and care are required to install foam insulation in finished walls. This type of insulation may be the only practical means to insulate certain types of homes and should be installed by a professional insulation contractor.

- Rigid board insulation is made of such materials as styrofoam, fiberglass, or urethane panels, and may be sold as building boards, sheeting, or wallboards. It is commonly used to insulate basement walls, and mobile home ceilings, or to cover existing siding.
- Reflective insulation is made of aluminum foil, sheet metal with a coating, and paper products coated with a reflective material. It is used to insulate walls and floors.

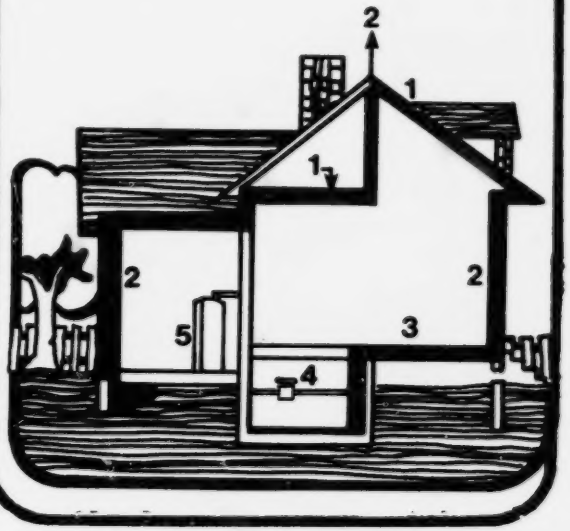
CEILING AND ATTIC INSULATION

You can save quite a lot on your heating and cooling costs by adding insulation to your uninsulated or inadequately insulated attic (or top floor ceiling if you don't have an attic). Even if you now have one or two inches of insulation in your attic, your home is still losing a substantial amount of heat.

Attics may have a finished or unfinished floor, or no floor at all. Some attics have ceiling walls. Your auditor has considered your particular attic type and has made recommendations in your Audit Results.

WHERE TO INSULATE A HOME

1. Attic floors, attic doors, or ceiling walls.
2. Exterior walls or walls between heated and unheated spaces.
3. Floors over unheated or o' side spaces.
4. Ducts or heating pipes in unheated areas.
5. Water heaters especially in unheated areas.



WALL INSULATION

Heat may be lost as it flows through the walls of your home to the outside. To reduce this loss, insulation can be added within most uninsulated walls. By reducing heat gains and decreasing air conditioning needs, this will increase your summertime comfort as well.

For the purposes of the RCS Program, we are recommending installation of wall insulation only if no insulation is in place in your walls. If some insulation is already there, it may interfere with the process of adding new insulation and may reduce the savings obtained from the installation of more insulation.

If there is no existing wall insulation, however, insulation can often be added between inside and outside walls. We suggest that you have wall insulation installed by a qualified building contractor rather than doing it yourself. Both the performance and safety of wall insulation could be affected by improper materials or installation.

FLOOR INSULATION

Many homes do not have insulation under the floor, although this area is a source of surprisingly high heat loss. If your heating bill is big enough to cause some concern, it's a good idea to insulate this area. The type and installation method will depend on your home's design. The underside of your home may be built using:

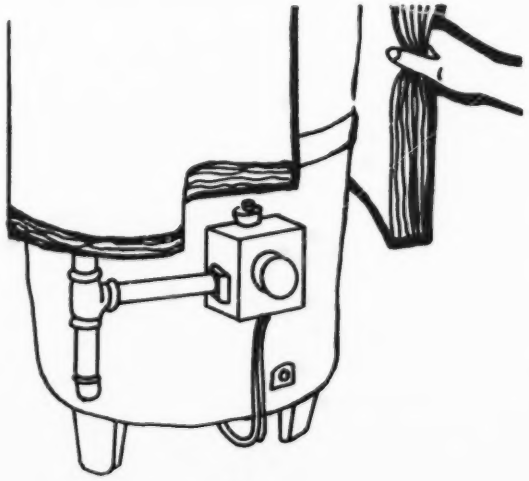
- a flat concrete slab sitting on the ground;
- a crawl space with walls around it;
- a floor over an unheated garage, unheated porch or open crawl space; or
- a combination of the above.

Your auditor has considered your home's construction in making the recommendations in your Audit Results.

WATER HEATER INSULATION

Your hot water heater generally uses more energy than any other appliance in your home. A great deal of heat is lost through the walls of the hot water storage tank. By insulating the outer surface, you can reduce this heat loss and the energy used to maintain the temperature of the heated water.

NOTE: Caution must be exercised when insulating a gas or oil water heater. DO NOT insulate the top or bottom of these types of heaters. If you insulate the top, you may interfere with the draft of the heater's flue. If you insulate the bottom, you may cut off air to the pilot light. ONLY insulate the sides of the tank for gas or electric water heaters.



DUCT AND PIPE INSULATION

It is important to insulate heating and cooling ducts or pipes located in unheated areas of your home.

Use blanket-type insulation that is about 1" or 2" thick. Make sure that the insulation has an attached vapor barrier, especially when insulating air conditioning ducts. The barrier will be placed facing out when installed.

NOTE: Before insulating your ducts or pipes, check for possible leaks. Tape any leaks shut with duct tape and then install the insulation.

Energy Saving Windows and Doors

During cold weather, heat is lost through your windows and doors. It can flow through the glass itself and escape from around the edges of windows and doors. During warm weather, unwanted heat enters your home in much the same way. Several different types of windows and doors can be installed in your home to reduce undesirable heat loss or gain. You can choose which best suits your individual needs.

STORM OR THERMAL WINDOWS OR DOORS

Storm windows and doors are separate units that can either be permanently installed over your existing windows and doors or removed during the summer. An air space is created between the two surfaces and acts as insulation. Thermal windows are units with two or more sheets of glazing material attached to a window frame. They are usually installed as replacements for existing single-pane windows.

You might decide to keep some storm doors or windows in place year-round to reduce summer heat gains, save on air conditioning, and increase your comfort.

HEAT REFLECTIVE AND HEAT ABSORBING WINDOW OR GLASS DOOR MATERIAL

You can help control summer overheating with a treatment that protects windows or glass doors from the heat of the sun. Various glazing materials, films, or coatings are available as assembled units and as kits for application on your existing windows. Some of these glass treatments are permanent; others may be changed seasonally. Be sure to ask suppliers about permanence before choosing a treatment for your windows and glass doors.

CLOCK THERMOSTATS

Lowering the thermostat for several hours each day during the heating season and raising it during the cooling season will save energy in a home with central heating and air conditioning. A clock thermostat will turn the heat down for you at night automatically and turn it up again in the morning at a pre-selected time. While you can easily adjust your thermostat yourself each day to energy conserving levels (such as 55°F at night and 68°F during the day in winter), a clock thermostat is a convenient alternative. Because a clock thermostat is so reliable, it might save more energy than if you try to do it yourself.

ELECTRIC LOAD MANAGEMENT DEVICES

You can reduce your personal energy costs by helping your electric utility manage its demand for electricity. The use of load management devices by residential customers allows a utility to maintain levels of reliability with less generating capacity by controlling service to particular customers. Utilities may offer a variety of these devices under several different financial arrangements. (About 20,000 consumers nationwide now have access to these devices.)

Remote Controlled Devices

Remote controlled devices link the control device in your home with your utility's control center through a communication system. For example, a utility can send out radio signals which activate switches on your water heater to disconnect the heating element for short periods of time. Both you and the utility benefit.

Nonremote Controlled Devices

These devices are installed in your house and are activated by certain on-site conditions. They include:

- o interlocks that allow one or several, but not all, major electric appliances in a home to be on at one time;
- o clocks that control electric power at selected times during the day or week.

A demand limiter that acts as a circuit breaker to limit electricity use is an example of this type of load management device. Customers purchase limiters with certain capacity. Then, for example, if the customer simultaneously operates 3 major appliances when the utility has a high demand for electricity from others, a small breaker is tripped to temporarily interrupt appliance operation.

Energy Storage Devices

One example of an energy storage device is a heat-storing ceramic brick furnace. At night, when the demand for electricity by residential customers is usually low, the bricks are electrically heated. During the day, the heat from the bricks is circulated in your home, reducing electric power demand at peak times.

Your auditor can more completely explain the availability of load management devices in your area.

Heating and Air Conditioning Efficiency Modifications

Heating or cooling your home accounts for a major portion of your energy use. It is important to understand two concepts associated with heating and cooling units: sizing and efficiency.

"Sizing" refers to the heating capacity of an oil or gas furnace. Many units are intentionally "oversized," meaning that they have more heating capacity than your home needs. As a result, they burn fuel too fast, switching on for only brief periods in all but the coldest weather. To correct an oversizing problem, you can replace your heating unit with a new one; howevever, replacing your burner could be sufficient. Because a new burner uses fuel more efficiently, it can be a good investment, even when added to a properly sized heating unit.

The "efficiency" is a measure of how well your heating system converts fuel or electricity to heat. The higher the system's efficiency, the less fuel is needed to keep your house warm. Correcting an oversizing problem increases the efficiency of a furnace.

An energy efficiency ratio (EER) is used to compare air conditioner efficiencies. It can be defined as the amount of heat removed from the air by an air conditioner divided by the amount of electricity used to operate the unit. The higher the EER, the more efficient the unit's operation.

The modifications described below can help you increase the efficiency of your heating and/or cooling systems.

REPLACEMENT FURNACES, BOILERS, OR HEAT PUMPS

If your furnace, boiler, or heat pump is more than 5 years old, consider replacing it. A newer system can be properly sized and more efficient in meeting your heating needs. Less energy will be used for the same level of heating comfort.

Be sure to shop around when you buy a new furnace. Some new furnaces are much more efficient than others.

If you decide to replace an old unit with a more efficient modern boiler, furnace or heat pump, the replacement unit should be sized to reflect the new decreased heating and cooling load resulting from any insulation or other energy conservation or renewable resource measures you may have added.

REPLACEMENT OIL BURNERS

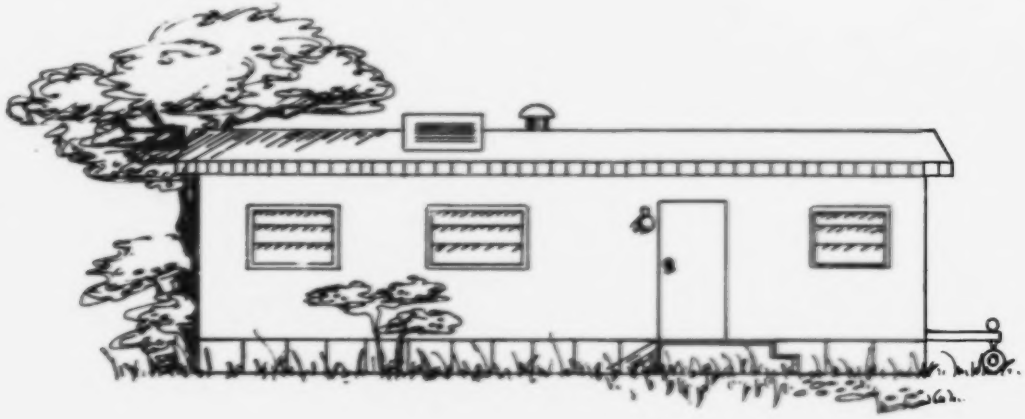
The efficiency of your oil heating system may be improved by replacing your existing burner. The rate at which you burn oil and the amount of useful heat you extract from the oil burned depend largely on the type and size of burner installed in your furnace. Yo fuel needs can be reduced by installing a properly sized high efficiency burner.

As you know, your RCS audit did not include an examination of the inside of your furnace. Before implementing this measure, it is advisable to have your furnace inspected to determine whether it is already equipped with such a device. Ask your auditor who to contact to do the furnace inspection.

VENT DAMPERS

The installation of a vent damper on your gas furnace can reduce your home's energy consumption by preventing heated air from escaping up your chimney after the furnace shuts off.

Since an improper installation could cause very serious safety problems, vent dampers should be installed only by qualified contractors. If you arrange installation through your energy supplier, the vent damper will be inspected within one week to assure you that all applicable safety standards have been met.



ELECTRIC IGNITION SYSTEMS

A gas pilot light in your furnace burns all the time. It uses gas continuously but is not needed until the thermostat calls for heat. The pilot light can be replaced with an electric ignition system which operates only when your furnace must be turned on. You should have a qualified heating contractor do this work for you. If you have your energy supplier arrange installation, the work will be inspected within one week to be sure that all applicable safety standards have been met.

REPLACEMENT CENTRAL AIR CONDITIONERS

If your central air conditioner is more than 5 years old, your home's cooling requirements can be met more efficiently with a new system. Because of design improvements over the years, newer units may have a higher energy efficiency ratio (EER), which means that less energy is needed to supply the same level of cooled air. If you are considering such a purchase, be sure to ask about the energy efficiency ratio. Manufacturers now put this information on the air conditioner labels.

This measure is included in the RCS audit only for homes with existing central air conditioners.

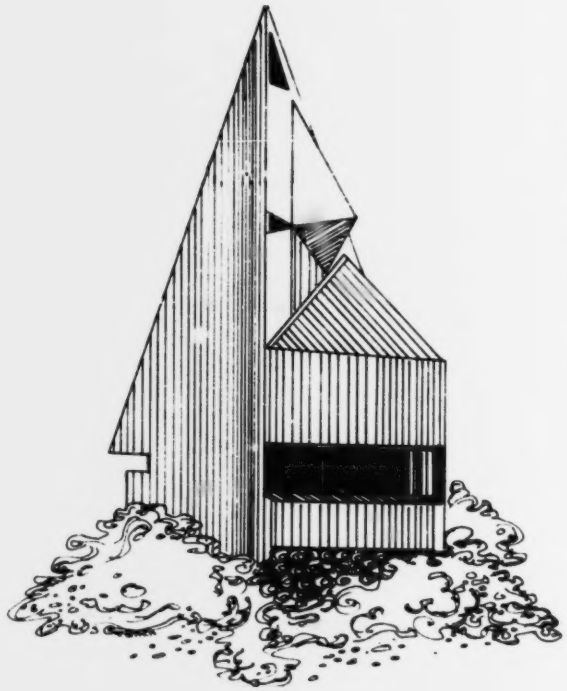
Notes:

Renewable Resources

The sun's energy is available for residential use—to heat water, to heat and cool your home, and to provide electricity. In fact, most homes already depend on the sun for some portion of their winter heating.

The renewable resource measures included in the RCS Program are intended to reduce your dependence on existing non-renewable energy sources such as oil, natural gas, propane or coal. Renewable resource systems obtain energy from the sun and provide it to you in a useful form.

Three general forms of renewable resource measures are included in the RCS Program: (1) active solar hot water and home heating, (2) passive solar heating and cooling, and (3) wind energy systems. Each of these measures is discussed in the following pages.



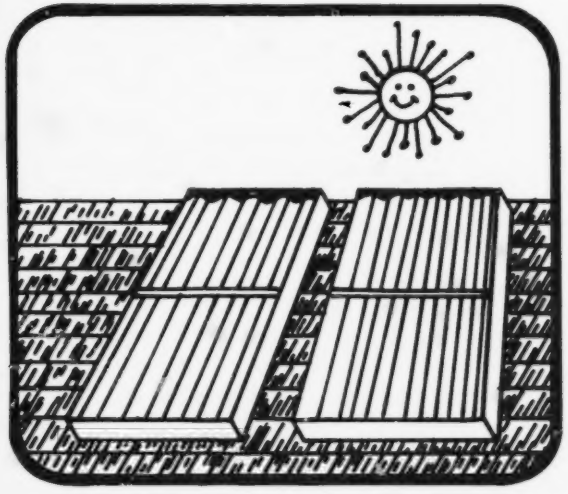
The estimates are informative, but they cannot precisely predict costs and savings for your particular home and living patterns.

There are a variety of organizations to assist you whichever renewable resource measures you choose to explore further. Be sure to note sources of information at the end of this booklet.

The energy cost savings estimates you receive are based on simulated conditions using systems which may be different from the ones you purchase. Estimated cost savings may, therefore, be different from the savings which you actually receive.

Active Solar Energy Systems

The category of solar energy systems designated as "active" include systems used to heat homes and also to provide hot water. Some systems combine both functions, providing heated water as well as heat for your home.



Once the sun's energy is captured in the collectors of an active system, it is then stored or sent directly to heat your home or the water you use. Active systems use controls, pumps, valves, and tanks for processing the sun's energy into a form useful for your needs.

There are natural limitations to the use of solar energy for residential purposes, however. The most obvious of these is that the sun's energy is not always available to you—for example, at night or during periods of extended cloud cover. Therefore, provisions must be made to store the energy for later use and to supplement the sun's energy with your home's existing hot water and heating systems.

Solar hot water and heating systems are of two major types: (1) packaged systems and (2) systems assembled from separate parts. Both types contain similar major components.

Active solar heating systems generally use air or water as a heat collection medium. The kind best suited for your home depends on the type of heating system you now use. Remember to get bids for various system types from several solar contractors.

For the calculations performed for your home, a glass covered flat-plate collector liquid system was considered. This system heats water before sending it to your existing hot water heater or storage tank. The system uses a storage tank to store heated water and, if your climate requires it, an anti-freeze solution or low temperature draindown for freeze protection.

Other types of solar energy systems than the one used for your audit are available, such as systems with air collectors and concentrating collectors, which may provide an equal or superior value for your investment. Many of the suppliers and installers on the RCS Program list can provide you with specific information for these alternate systems.

The annual cost of maintaining these systems, not considering the period covered by warranty, is estimated to be 2% of their initial cost. Warranties generally cover a 3-year period of maintenance.

The Audit Results advise you on preferred approaches for using the sun's energy to heat your home. Whichever method you choose, before you adopt solar heating, you are advised to tighten up your home and add needed insulation. Your solar energy system will provide greater benefits relative to your investment in a well insulated and otherwise energy-efficient house.

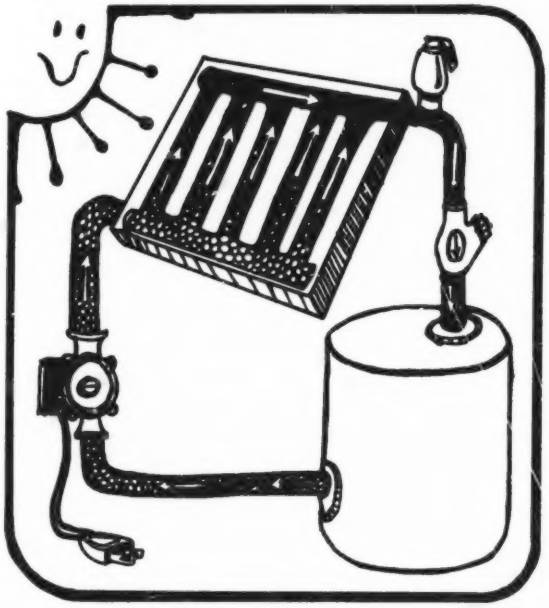
Finally, a note of caution. For most houses, the use of an active solar system will require placing solar collectors on your roof. For most roofs, this additional load will pose no problems. However, some roofs will need repair and strengthening before they can support an additional load. If you have doubts about the capacity of your roof to handle the added load, you are advised to have your roof inspected before you proceed with the installation of roof-mounted solar hardware.

SOLAR HOT WATER HEATERS

A solar hot water system collects and converts the sun's energy into heat for your hot water needs—baths and showers, dishwashing, and laundry. A unit such as the one shown in the sketch can provide most or all of your hot water needs during the summer. During the winter months or heavily clouded periods, it will provide some of your hot water, and your existing water heater will provide the rest.

You can increase a solar energy system's contribution by timing your use of hot water. A solar energy system will collect the major part of its energy during the "prime solar time," generally between 9 a.m. and 3 p.m. Timing your major uses of hot water to coincide with this period and the several hours following will significantly increase your benefits.

Although a person with solid plumbing and electrical skills could assemble this type of system as a do-it-yourself home improvement project, you are advised to read up-to-date information and consult with your local building inspector before embarking on the project.



ACTIVE SOLAR HEATING SYSTEMS

An active solar home heating system provides heat for the living space in your home and is usually designed to rely on a conventional heating system as a backup, especially during extended periods of cloud cover. Solar heat is supplied to a house through the use of collectors and a storage system that are tied in with the existing heating system.

NOTE: Do-it-yourself installations affecting your heating system are not recommended.

COMBINED ACTIVE SOLAR HEATING AND HOT WATER SYSTEMS

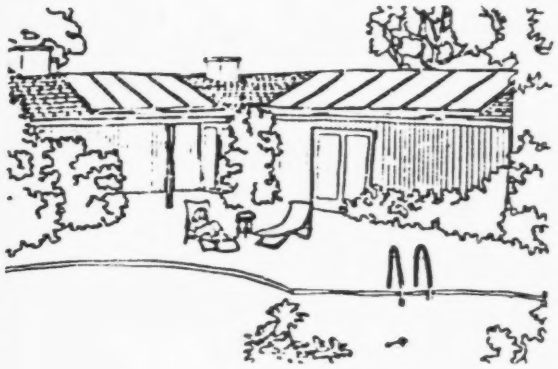
A combined solar heating and hot water system can provide heat for the living space of your home as well as for your hot water. Combining the functions of the individual solar energy systems, such a unit can supply much of your heating and hot water needs. During the summer, this system type can provide most or all of your hot water. During winter months, it will provide a substantial quantity of both your heat and hot water; existing heating and hot water units provide the rest. Solar heat is usually supplied to a house using collectors and a storage system that are tied in with your existing heating and hot water systems.

NOTE: Do-it-yourself installations affecting your heating system are not recommended.

REPLACEMENT SOLAR SWIMMING POOL HEATERS

Solar energy can be used to reduce dependence on non-renewable fuels for swimming pool heating. If you own a swimming pool currently heated by conventional fuel, your audit included an assessment of your pool heating needs based on the pool's size, exposure to wind, and available space for locating solar pool heating equipment. The system considered for the calculations performed for your home is a glass covered flat-plate collector liquid system.

A do-it-yourselfer could obtain the necessary materials to install a solar swimming pool heater.



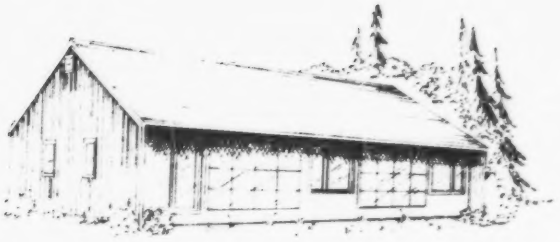
Passive Solar Energy Systems

Passive solar heating and cooling systems use the structure of your home for heating, cooling, and energy conservation. Natural forces—including sunshine, shading, and breezes—are used to help heat or cool your home with little or no use of electrical controls, motors, or fans.

For each of the heating systems considered for the audit, most heat will be obtained when the sky is sunny and clear. Yet, depending on the outside temperature, heat can also be expected on moderately cloudy days as well.

Passive heating depends upon "thermal storage mass" to absorb and store the sun's energy for use within your home. As used here, storage mass includes materials such as stone, concrete, or water, which store large quantities of heat as they absorb the sun's energy. This storage is accompanied by a moderate rise in temperature—the larger the temperature rise, the greater the energy stored. Later, as the thermal storage mass cools, the stored heat is released to heat your home.

A passive solar energy system may need some cooperation from your family to perform at its peak. For example, you may need to slide insulation into place to close off the passive heating sources at



night or during periods of extended cloud cover to reduce heat losses, or you may need to open and close vents to control heat flow.

For the most part, the methods described here are relatively easy to use; passive solar energy systems are good projects for the do-it-yourselfer. Many people living in a range of climates have been able to adopt low-cost approaches to using passive solar energy effectively in their homes.

DIRECT GAIN GLAZING SYSTEMS

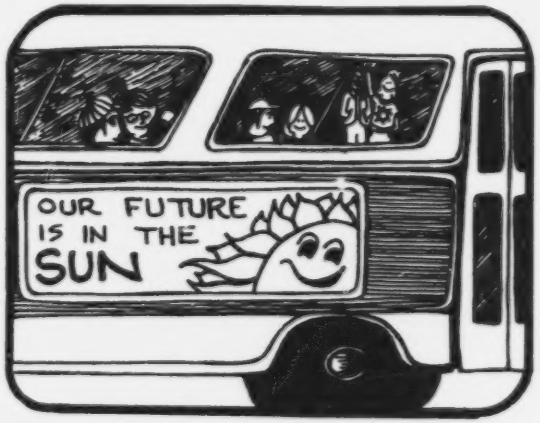
Direct gain is a simple—and very common—method of obtaining heating benefits from the sun. Sunlight enters your home directly through south-facing windows. The heat from the sun is absorbed by the mass of your floor or interior walls. This heat is then slowly released to warm your home, assisted by your present heating system. A direct gain glazing system allows the rooms of your home to become live-in solar collectors.

The glazing you add to your home may be either single-layered or double-layered, depending on local climate. Glazing can be glass, plastic or another transparent material. Whichever type you select, it is beneficial to use some type of movable insulation to reduce your heat loss at night. Sliding insulating panels or edge-sealed insulated drapes, for example, can be used.

A do-it-yourselfer with skills in carpentry and glazing can install these systems as a home improvement project.

INDIRECT GAIN SYSTEMS

Indirect gain systems include a wide range of passive solar heating techniques. These techniques involve capturing the heat in sunlight and storing it before it is released to living spaces. Walls, ceilings or other surfaces can be constructed of materials that absorb, store and release the sun's heat. Masonry and water storage containers are most commonly used for this purpose. These indirect gain systems are called "Trombe walls" and "water walls."



Another indirect gain system is the thermosyphon air panel which can be added to a south wall of your home. Heat is absorbed by these panels; the heat is transferred to the air drawn through the panel. The heated air is then circulated through vents into the living space of your home.

Some indirect gain systems operate automatically, using thermostatically controlled mechanisms. With others, you will be able to receive maximum heating benefits by opening vents and allowing heat to flow into your living spaces. You will also need to close the vents during sunless periods (for example, at night or during periods of extended cloud cover).

Compatibility of these systems with your home depends on floor, wall and foundation construction.

A skilled do-it-yourselfer can install indirect gain systems as a home improvement project.

Some of these systems may be eligible for the federal income tax credit and others may not. Check with your local IRS office about which systems are eligible.

SOLAR GREENHOUSES

This type of passive solar energy system is sometimes known as a solarium or sunspace and is attached to a south-facing wall. Sunlight is absorbed by thermal storage mass contained in the greenhouse (such as bricks or water in containers), which then radiates heat. Some of this heat is transferred into the home's living space. Your home is then heated both by your greenhouse and by your present heating system.

Existing doors and windows are frequently used to allow heated greenhouse air to flow into living spaces. The greenhouse can be sealed off from the rest of the house when too much heat is gathered or when there is insufficient sunlight to contribute to home heating. Closing the doors or windows at night, or on particularly cloudy days, may also be necessary.

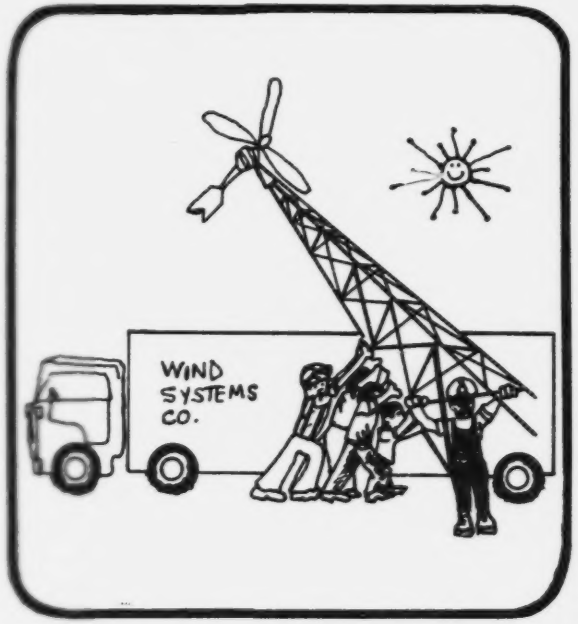
A solar greenhouse can provide heat and additional living space, as well as the opportunity to grow vegetables during most of the year, in nearly all climates.

Building a solar greenhouse is a good do-it-yourself project, especially for small groups of neighbors and friends.

WINDOW HEAT GAIN RETARDANT DEVICES

Your home can be kept cooler in summer if you restrict the amount of sunlight streaming in. Devices such as awnings, insulated roll-up shades, metal or plastic solar screens, and rigid movable insulation, properly installed on your south-facing (and other) windows, can reduce the heat your home gains from sunlight. The interior temperature of your home will stay lower and your need for air conditioning will be reduced by use of such devices. Even if you don't have an air conditioner, you can still enjoy an increase in comfort through reducing summertime heat gain through windows.

Wind Energy Systems



Known by the familiar term "windmill," wind energy systems are devices that capture the energy in the wind. Windmills have a long and colorful history. They have been used for centuries, in all parts of the world, for pumping water, grinding grains, and powering mechanical units. Today's increasing energy costs are making wind energy systems good investments for people in many parts of the country.

The type of wind machine currently included in the RCS audit produces electricity which can be used in your home for lighting, heating, and operating

appliances. Wind, a natural resource, turns the blades of the wind energy system, turning a generator which is tied in to the electrical system of your house.

Because electricity is produced by a wind energy system when the wind blows, at times more electricity will be produced than you need. At other times, less electricity will be produced than you need. When you need electricity, it is purchased from the utility company.

Excess electricity that you produce is available to be sold back to your utility company, if its policies provide for it. Your auditor can explain the utility company's policies. Estimates for wind machine production of electricity don't depend on whether or not you are interconnected to the utility grid.

Wind data developed for the RCS audit were from two sources:

- o measuring stations with useful data; and
- o regional wind resource maps which show an estimated annual average wind speed.

Your Audit Results show which of these two sources was used for your wind audit.

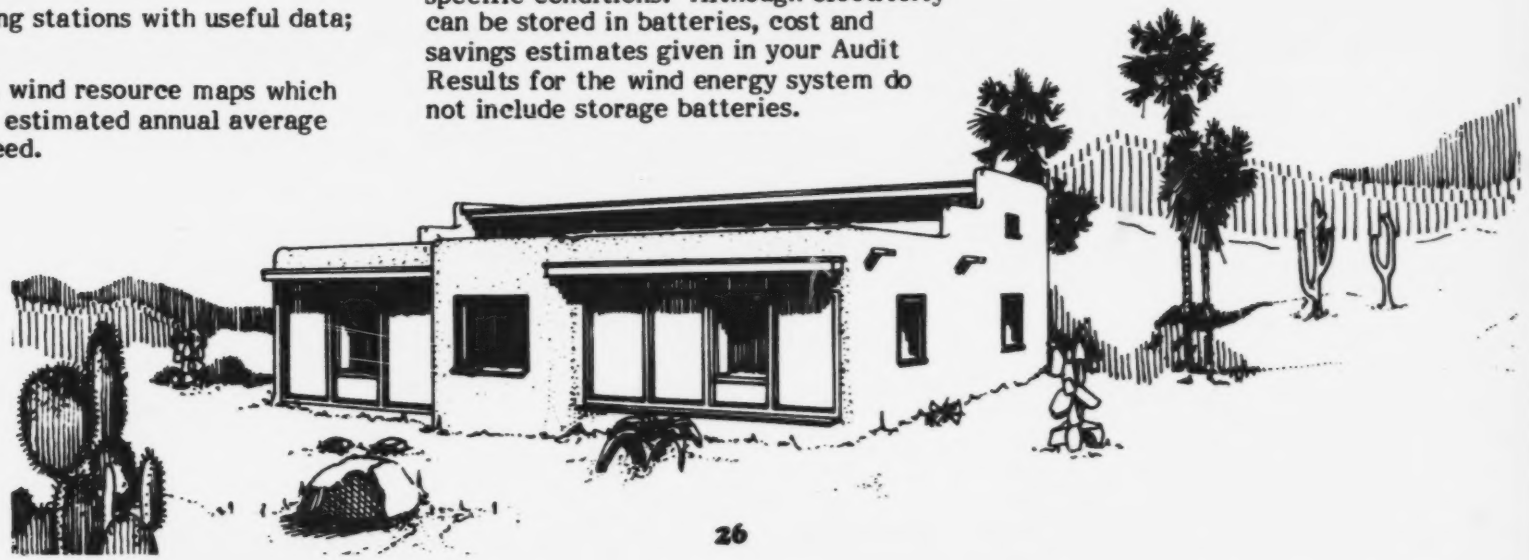
With this wind resource estimate, a wind energy system has been considered which meets about 50% of your annual electricity needs. If the wind resource at your site is less than this value, the wind system will produce less than 50% of your electrical needs. If the wind resource at your site is more than this value, the wind system will produce more than 50% of your electrical needs.

If you arrange installation through your energy supplier, the work will be inspected within one week to be sure that applicable safety standards have been met.

The cost information provided in your Audit Results includes an installation cost which could vary widely due to site-specific conditions. Although electricity can be stored in batteries, cost and savings estimates given in your Audit Results for the wind energy system do not include storage batteries.

Check the easements on your property for siting of your wind machine.

The Department of Energy recommends that you use a qualified designer and installer for wind energy systems rather than doing it yourself.



How to Find Out More

INFORMATION ON ENERGY CONSERVATION

Many free pamphlets and inexpensive books are available from:

- o U.S. Department of Energy
  Technical Information Center
  P.O. Box 62
  Oak Ridge, TN 37830
- o Consumer Information Center
  U.S. Public Document Distribution Center
  P.O. Box 713
  Pueblo, CO 81001

INFORMATION ON RENEWABLE RESOURCES

Several organizations can help you find more information on renewable resource measures. The National Solar Heating and Cooling Information Center (P.O. Box 1607, Rockville, MD 20850) is operated for the Department of Energy to answer consumer questions of all kinds. Its toll-free telephone number is 800-523-2929. (In Pennsylvania, use 800-462-4983.)

The Solar Energy Research Institute at Golden, Colorado, the nation's lead center for solar energy research, has a National Solar Inquiry and Referral Service. Their toll-free number is 800-525-5000. (In Colorado, use 800-332-8339.)

Regional Solar Energy Centers operated for the Department of Energy are other sources of information for renewable resource measures in your region. Addresses and consumer inquiry telephone numbers for the regional centers are:

- o Northeast Solar Energy Center
  470 Atlantic Ave
  Boston, MA 02110
  617-292-9250
- o Mid-American Solar Energy Complex
  Alpha Business Center
  8140 26th Ave So.
  Bloomington, MN 55420
  612-853-0400
- o The Southern Solar Energy Center
  61 Perimeter Park
  Atlanta, GA 30341
  404-458-8765
- o Western Solar Utilization Network
  Pioneer Park Building
  715 S.W. Morrison
  Suite 800
  Portland, OR 97205
  503-241-1222

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